Fostering Participation of Local Actors in Volcanic Disaster Risk Reduction

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Abstract

Studies of recent volcanic crises have revealed that official evacuation and contingency plans are often not followed by communities at risk. This is primarily attributable to a lack of long-term coordination and planning among concerned stakeholders, and in particular, a lack of participation of local populations in disaster risk reduction (DRR). A lack of participation suggests the prevalence of top-down approaches, wherein local people are disengaged or even excluded in the development of DRR plans. It is not surprising, therefore, that existing plans are often non-operational, nor acceptable to the people for whom they are intended. Through an investigation of case studies at Mount Rainier (USA) and Bulusan (Philippines), and references to volcanoes elsewhere, this chapter aims to determine the key principles and important considerations to ensure peoples' participation in volcanic DRR. The chapter discusses key factors that encourage local empowerment, engagement, influence, and control in development of plans and actions. It adds information to the existing literature about how participatory approaches can encourage contributions by both local and outside actors, the latter providing knowledge, resources and skills when unavailable at local levels. Such approaches promote dialogue and co-production of knowledge between the community and outside actors. Contributions from multiple and diverse stakeholders

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further enable all groups to address the underlying social, economic, political and cultural issues that contribute to the vulnerabilities of local people. Consequently, DRR becomes more sustainable because local actors are not fully dependent upon outside actors and resources, relying instead on local capacities.

1 Introduction

Volcanoes, especially active ones, are generally perceived as sources of hazards by outside actors of disaster risk reduction (DRR), particularly scientists and government authorities (Cashman and Giordano 2008). For local inhabitants, however, volcanoes often hold deeper meaning because they become emblems of a homeland, often with long lived and deep cultural significance; and are a source of livelihoods and spiritual strength (Donovan 2010). This duality also explains, to some extent, the different perceptions and understanding of DRR between local actors (in particular local authorities and people), and outside actors (e.g., scientists, government agencies, and non-government organizations).

In development and disaster studies, local actors often refers to individuals and groups of people occupying or attached to a specific community and/or territory which include but are not limited to inhabitants, officials, local organizations, and different social groups including the most marginalized (e.g., Gujit and Shah 1998; Heijmans 2009). Here, we refer to local actors as a "collection of people in a geographical area" who "share a particular social structure", "have a sense of belonging", and whose "daily activities take place within the geographical area" (Abercrombie et al. 2006, p. 71). It is important to note, however, that a community can also be "relational" referring to a "quality characteristic of human relationship, without reference to location" (Gusfield 1975, p. xvi). This also suggests that 'local actors' cannot be used to refer to a set of homogenous groups in different contexts.

Outside actors, unlike local actors, do not exemplify a sense of community and/or identify themselves as part of a set of relationships within a specific geographical area. Sometimes, outside actors unknowingly insist on implementing actions based on plans and policies that are at times contradictory to local actors' views and needs. During times of crisis, these plans may fail. Programmes initiated and maintained solely by outside actors can result in an ineffective DRR process, loss of local knowledge and deepening mistrust between the different actors of DRR (Haynes et al. 2008; Mercer and Kelman 2010). There are, however, stories of success of communication between local and outside actors despite the great complexity of a volcanic crisis. During the reawakening of Mount Pinatubo in 1991, local people, unaware that they lived on the slopes of a volcano noted steaming and ground cracks. This information was relayed to authorities, who found it necessary to initiate a rapid top-down education campaign with the eventual valuable inclusion of local actors (Punongbayan et al. 1996).

Reducing disaster risk requires the participation of local actors in many aspects and stages of volcanic DRR (Wisner et al. 2012). During a crisis, volcanic activity contingency plans created only by outside actors can become non-operational due to being unacceptable or unfamiliar to local actors. Some well-recognized examples of disasters that resulted in great human casualties due to lack of collaboration between outside and local actors include the eruptions of Nevado del Ruiz volcano in 1985 (Voight 1990) and Merapi Volcano in 2010 (Kusumayudha 2012; Mei et al. 2013). To foster the participation of local actors in volcanic

DRR, community-based and participatory approaches have been employed by scientists, government agencies, and NGOs.

This chapter provides a rationale for the inclusion of local actors in reducing disaster risk and reaffirms the importance of integrating bottom-up and top-down actions in the entire DRR process. Some questions that this chapter aims to address are how local actors can be integrated in components of volcanic DRR. What are the key principles and important considerations for policy and practice to ensure peoples' participation in volcanic DRR?

2 Participatory Approaches to Volcanic DRR

Fostering local actors' participation through bottom-up and community-based initiatives is an alternative to isolated technocratic, top-down, command-and-control approaches to DRR. Participation refers to "a voluntary process by which people (…) influence or control the decisions that affect them" (Saxena 1998, p. 111). It is often defined along a continuum, ranging from total lack of control to self-mobilising initiatives where local actors own and control decision making (Arnstein 1969; Chambers 2005). Participation therefore refers to a process, rather than an outcome, and includes sharing and redistribution of power among stakeholders of DRR.

Since the 1970s, Civil Society Organisations (CSOs: non-state actors such as non-governmental organisations (NGOs), non-profit organizations (NPOs), social and religious organizations, among others; Kaldor 2003), have been promoting a shift in power relations to the benefit of local actors who face volcanic risk. In a few countries, such as New Zealand, the USA, and recently, Colombia, national and regional governments promote and even mandate participatory engagement, but the majority of volcanic regions around the world are still subject to top-down mitigation approaches. The practice of community-based and participatory DRR was widely promoted in the 1980s as Community-Based Disaster Risk Reduction (CBDRR), through the creation of national and international networks of CSOs involved in grassroots activities (Heijmans 2009; Delica-Willison and Gaillard 2012). Proponents of CBDRR advocate that local actors are better placed than a central government to implement DRR actions as, in addition to considerable local knowledge and cultural understanding, their lives and livelihoods are at stake, therefore providing greater incentive to plan and take action. Both the scientific and practitioner literature acknowledge the capacities of local actors in responding to volcanic hazards on their own, as long as they are empowered with adequate organizational resources (e.g., Quarantelli and Dynes 1972; Delica-Willison and Willison 2004; Bowman and White 2012).

CBDRR consists of self-developed, culturally and socially acceptable, economically and politically feasible ways of coping with and avoiding disasters (e.g., endogenous resources, skills and local knowledge) (Maskrey 1984). This does not necessarily exclude external support, but provides access to external knowledge about hazards and risk, and educational and preparedness resources where needed, without perpetuating a cycle of dependency. CBDRR thus requires the participation of outside actors. In CBDRR, participatory approaches are frequently adopted for hazard, vulnerability and capacity analysis and the subsequent development of strategies and actions, for example to assess risk, raise hazard awareness and develop community-based warning systems. In some localities CBDRR evolves, with the occasional guidance of outside actors. Lessons drawn from practice are always considered to improve CBDRR, thereby ensuring it is flexible and adaptive to adjust to changing physical and social environments. It ultimately aims to empower people, which requires "transformation of existing social, political and economic structures and relations in ways that empower the previously excluded or exploited" (Hickey and Mohan 2005, p. 238).

Fostering people's participation in CBDRR requires innovative and flexible methodologies such as those featured in the Participatory Learning and Action (PLA) approach. PLA is "a growing family of approaches, methods, attitudes and behaviours to enable and empower

people to share, analyse and enhance their knowledge of life and conditions and to plan, act, monitor, evaluate and reflect" (Chambers 2002, p. 2). Outside actors do not dominate the process but provide support to initiatives of local actors who know local issues best. CBDRR is thus a means to flip power relationships and encourage more meaningful participation through downward accountability towards local actors (Chamber 1983; Cornwall et al. 2000; Breett 2003).

Unfortunately, as Cornwall (2008, p. 269) states, "participation' can be used to evoke—and to signify—almost anything that involves people. As such, it can easily be reframed to meet almost any demand made of it". In many instances, participation is in fact seen as an outcome, rather than a process (the 'tyranny of participation', Cooke and Kothari (2001)). In cases where CBDRR is driven exclusively by outsider interests (White 1996), and that marginalized groups and "disadvantaged individuals" remain "excluded from participatory decision-making" (Pelling 1998, p. 484). Projects and activities are pre-designed by outsiders who make sure that enough local actors take part to report alleged "participation" upward to funding agencies (see Bowman and White 2012). This skewed approach to participation is evident in the many assessments of vulnerability and capacity that provide statistics based on standardized frameworks (demographics, gender characteristics, incomes, resources, health, etc.), from which plans are made and imposed upon local actors (Twigg 1998; Heijmans 2004). In many instances, although potentially useful on a governmental level for rapid prioritization of resources, these alien frameworks do not make much sense to local people in the context of the reality of their everyday life (Bhatt 1998; Delica-Willison and Willison 2004), and thus discourage participation, especially when concerns for survival take highest precedence (see the case of volcano Cerro Machin, Colombia Chap. 16).

Participatory approaches can rely heavily on the skill of one or more facilitators, who play a key role in the process (Duncan 2014). Challenges for the facilitator include ensuring the inclusion of the most marginalized people, managing the community's expectations of the process and balancing their role as a facilitator and as educator (e.g., Cronin et al. 2004). CBDRR has also been criticised for reinforcing the interests of the already powerful within communities, as it often proves difficult to reach the less powerful, more marginalised people that it is meant to empower (Cooke and Kothari 2001). This concept is balanced with the recognition that there is value in working with local actors who possess leadership qualities and who are opinion leaders within the community.

The following sections address the issues mentioned above in the context of volcanic environments in two different regions of the world: Mount Rainier, USA and Bulusan Volcano, Philippines. These cases were selected because they respectively provide accounts of long-term and short-term participatory approaches to CBDRR in disaster preparedness and crisis management based on first hand in-depth research from some of the chapter authors. The two case studies are not meant to be compared. They are considered examples of good practices of participatory volcanic DRR in two different contexts—disaster preparedness and crisis management. They also serve as a means of exploring the strengths and limitations of CBDRR in fostering disaster preparedness and crisis management.

3 Disaster Preparedness at Mount Rainier, USA

Mount Rainier is a 3392 m high volcano in the Cascade Range and the highest mountain in Washington State, USA (Fig. 1). It is recognized as one of the nation's most hazardous volcanoes (Ewert et al. 2005), with 78,000 people residing in the lahar-prone Puyallup River Valley (Wood and Soulard 2009). In some localities, the next lahar could reach communities with only about one-half hour of warning.

During the 1990s, a series of new publications (Scott et al. 1995; Scott and Vallance 1995; Hoblitt et al. 1998) highlighted Mount Rainier's hazards, especially its severe lahar hazard, and it motivated scientists to inform local officials and the public

Fig. 1 Mount Rainier dominates the landscape over the Puyallup River valley and the city of Orting (foreground). Around A.D. 1500 a landslide-driven lahar flowed down the west flank of Mount Rainier and inundated the valley floor. *Photograph by* E. Ruttledge, USGS, January 2014

through multiple presentations. The scientists' aim was to advise local people about the risks of living in lahar-hazard zones so that they could visualize undesirable outcomes and assume responsibility for CBDRR. They recognized that participatory methods might sustain "a long-term conversation" (Mileti 1999), and that people at risk might progress from initial hazard awareness to understanding of the risk, and belief in their ability to take effective mitigative action. Such progression comes from personalizing and then, confirming the risk with others, developing intentions for action, and making mitigative actions, as categorized variously in social models (e.g., Sorensen 1982; Sorensen and Mileti 1987; Paton 2003). At Mount Rainier, the resulting effort is driven by three groups, each contributing to the larger effort according to their organizational mission, resources, and needs.

(1) The first group of local actors consists of local emergency managers, at county, city, and fire district level, with professional responsibilities for the safety of the local community. During the mid-1990s, this group, in conjunction with state officials, called into being the Mount Rainier Volcano Work Group, which led first to development of an emergency response plan (Pierce County 1998, updated in 2008). They worked with the US Geological Survey (USGS) to install a lahar-detection system, followed by county and state efforts to build a public notification system consisting of emergency broadcasts, personal electronics notifications, and sirens (Pierce County 2014). This effort is augmented by a series of volcano-evacuation route signs, which point to high ground and safety during a lahar. Community-based emergency educators added volcano hazards to neighbourhood multi-hazard emergency preparedness training, including interactions with marginalized populations. In conjunction with local actors, the county developed lahar-evacuation routes that are displayed on a new inter-agency website (Pierce County 2014). In the words of one local safety official within the lahar-hazard zone, "We will not be victims of the next lahar. Our agency will aid the community in the best way possible because we have taken the time now to plan and prepare".

(2) A second important group of local actors consists of enthusiastic community members and school safety officers who have developed a series of resident-driven efforts to mitigate problems associated with potential lahars. After scientists in the mid-1990s informed them of the lahar risks, local residents initiated a long-term sequence of lahar evacuation drills for thousands of students (Fig. 2) in the towns of Puyallup and Sumner (Caffazo 2014), and in Orting (Orting School District 2015). In the community of Orting, local residents raised funds for initial design of a system of efficient but costly walkways and pedestrian bridges across a highway

Fig. 2 Students practice evacuation during a 2002 lahar drill in downtown Orting. During an actual lahar, the lahar detection and notification system would provide residents of the city with approximately 30 min of warning, which is marginally sufficient for evacuation from some lahars. *Photograph by* C. Driedger, USGS, October 2002

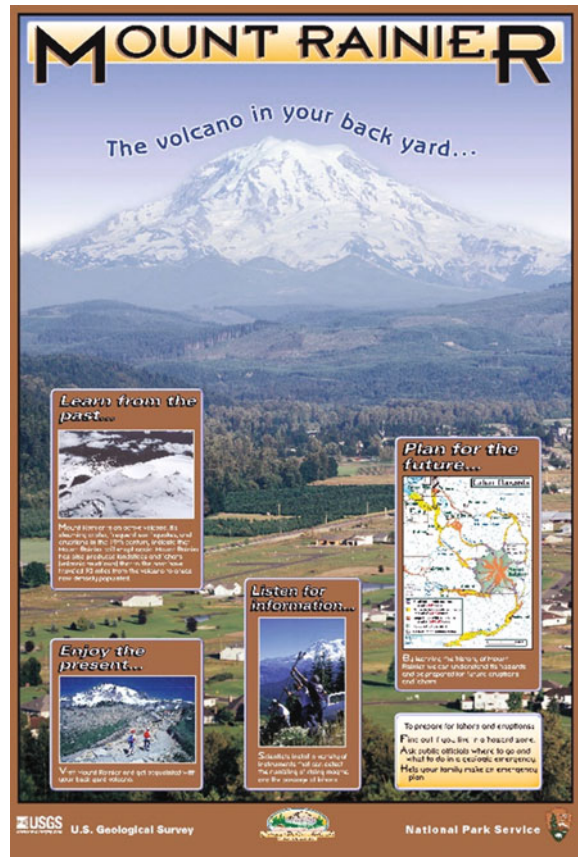

Fig. 3 Public meetings concerning the threat of lahars prompted local teachers to outline the scope, messaging, and content of Mount Rainier volcano teaching materials such as this poster with an activity guide on the back side. *Photograph by* C. Driedger, USGS, 2003

and river that, if built, would shorten evacuation routes by enabling rapid egress to high ground (Bridge4kids 2014; Plog 2014). Local teachers proposed and participated in development of teaching materials (Driedger et al. 1998, 2005, 2014) (Fig. 3). School students developed a

lighting system to improve night time visibility of some volcano evacuation route signs which are installed in the Puyallup, Carbon and Nisqually River valleys (Fig. 4).

(3) As outside actors, state and federal emergency managers, scientists, and park staff provide as-needed technical, organizational, and occasional financial assistance as needed (Pierson et al. 2014). Since the mid-1990s, this has required almost half-time involvement by one outreach specialist at USGS, who attends local meetings, answer inquiries, and aids in product development. Staff at USGS and Mount Rainier National Park (MRNP) sponsor an annual teacher training. USGS scientists train park staff, and aid with development of geohazard-oriented displays (Driedger et al. 2002). Federal funds supported development of a "web portal" that indicates hazards of individual property parcels (Washington Department of Natural Resources 2014). USGS produced an assessment of risk (Wood and Soulard 2009), and provides volcano trainings for officials and the public. Washington Emergency Management Division and USGS assembled a media guidebook (Driedger and Scott 2010). Local and outside actors developed an outdoor interpretive sign about Mount Rainier hazards (Schelling et al. 2014). Product development methodology is based upon the premise that no single agency can know the needs of residents unless representative users are involved in determination of need, design, development, review, and implementation (Perry et al. 2016). Several important observations emerged. Multi-level participation in CBDRR allows each entity to make contributions that strengthen the entire effort, and promote long-term continuity. Enthusiasm and creative ideas from local actors whose lives and livelihoods are at stake provide long-term motivation for continual mitigation plan upgrades. CBDRR efforts are stronger because of the long-term commitment of scientific, organizational, and occasional financial support from outside actors. A motivated hazards-aware citizenry can initiate mitigation efforts that meet community needs, yet are

Fig. 4 In the Puyallup, Carbon and Nisqually River valleys, volcano evacuation route signs direct drivers towards high ground, and they serve the additional educational purpose of reminding local residents of the hazards and/or of the need for protective action. Students in the Orting School District developed the idea of enhancing some of the signs with placing flashing orange lights powered by solar panel to improve use during darkness. They developed a proposal and submitted it to authorities who funded the project. *Photograph by* C. Driedger, USGS, October 7, 2014

beyond the financial means of local governments. Community officials are considering a variety of funding sources and multiple options for rapid lahar evacuation. In the words of one resident activist, "*The people have led and many leaders have truly heard, taken to heart, and acted upon the concerns and solutions proposed by its citizenry.*"

4 Locally-Led Crisis and Evacuation Management at Bulusan Volcano, Philippines

Bulusan Volcano is a 1559 m high stratovolcano formed inside a caldera. It is one of the most active volcanoes in the Philippines having erupted at least 16 times since late 1800s. Recent eruptions, such as in November 2010 to November 2011, were characterized mainly by ash ejection and volcanic earthquake swarms and resulted in recurrent mass evacuations of nearby towns (PHIVOLCS 2014). At least six municipalities and hundreds of *barangays* (villages) under political jurisdiction of the province of Sorsogon are situated at the foot of the volcano. Barangay Cogon—the nearest village to the summit of the volcano—has a total population of 1020 people in 211 households and is within the probable danger zone of the volcano, defined as 4–10 km from the summit (Municipality of Irosin 2012). However, agricultural areas especially coconut plantations, the backbone of the village economy, are within the 4 km permanent danger zone.

Between 18 and 20 February 2011, a CBDRR was implemented in Cogon involving officials and representatives from multiple sectors of the community. The activity was initiated by Integrated Rural Development Foundation of the Philippines (IRDF), a local NGO advocating for the participation of local actors in DRR. The objectives of the activity were twofold: risk assessment through Participatory 3-Dimensional Mapping (P3DM) and development of a volcanic activity contingency plan for the village. The 3D map provides local actors with a bird's eye view of their territory, giving them a clear picture of important community information in order to determine their vulnerabilities, capacities and exposure to volcanic hazards (Fig. 5) (Cadag and

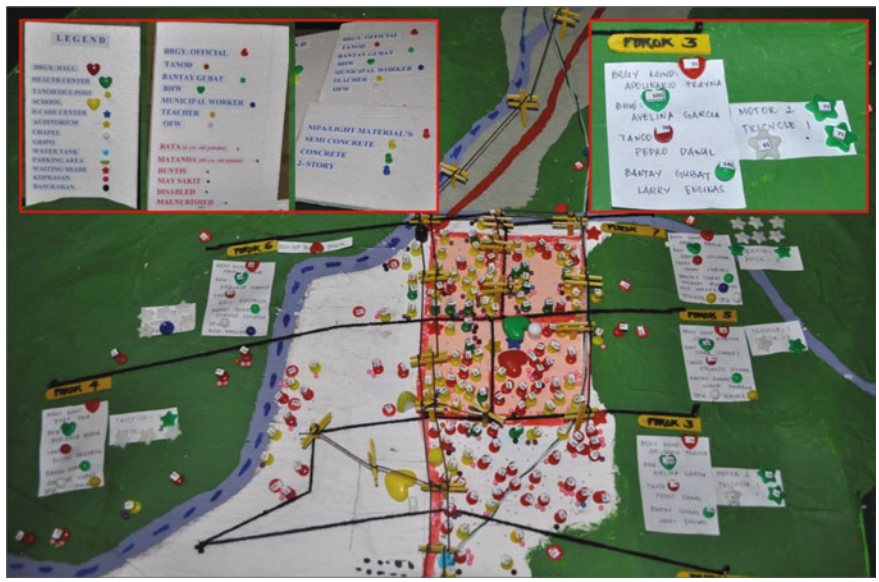

Fig. 5 Large-scale participatory 3-dimensional map (1:1250) of Cogon, Irosin, Philippines showing hazard-prone areas (shaded with *grey paint*), vulnerable assets and people and local resources (both depicted with push pins), February 2011 (adapted from Cadag et al. 2012: 84)

Gaillard 2012). Local participants traced information on the 3D map that are useful for risk assessment. The information was then subsequently confirmed and further improved by outside actors (e.g., municipal DRR officer, NGO personnel, and local scientists) to ensure precision (in terms of location) and compatibility with their plans. Likewise, the contingency plan developed during the CBDRR details the roles of local actors (e.g., village chief and councillors, health workers, village police and representatives from different sectors of the community) in the entire evacuation process, particularly in the management of the evacuation area. The approach and tool (i.e. P3DM) was highly appreciated by the participants because of its effectiveness in engaging actors from the different sectors and in combining their plans for DRR. According to the representative of the Disaster Risk Reduction and Management Office of the municipality, "CBDRR is not new to us… But it is the first time that we assess risk and plan actions (for DRR) using a single tool (3D map) that we all understand."

On 21 February, 2011 at 9:12 a.m., only a day after the CBDRR activity, the volcano suddenly erupted and ejected volcanic ash for several minutes (Fig. 6). There were no warnings from the Philippine Institute of Volcanology and Seismology (PHIVOLCS) nor municipal officials. It took only about 15 min for ash fall to reach the village of Cogon, reducing visibility to zero and rendering lamps and flashlights useless. Evacuation vehicles from the municipal center were unable to reach the village. Community members, particularly the local leaders, were thus the first to facilitate the evacuation. Three hours later, with the help of municipal rescue units and other volunteers, most of the residents of the village were evacuated to a school at the municipal center, situated 10 km away from Cogon.

At the onset of the crisis, the evacuation center was managed by the municipal officials and school coordinators. Yet, despite their best efforts, observations of participants and informal interviews revealed that the evacuation center was chaotic and under-prepared but only for the first half day. For example, only a few rooms and toilets were available; food distribution was delayed; and trashcans were full. This made evacuees uneasy; they did not have any idea of the government's efforts, nor of what was going

Fig. 6 Eruption of Mt. Bulusan, Philippines on February 21, 2011 at 9:12 a.m. *Photograph by* J. Cadag, 21 Feb 2011

to happen to them. Lack of coordination and communication among the affected populations and the authorities was quite evident (Cadag et al. 2012). In the late afternoon of the same day, village officials of Cogon decided to implement their newly conceived contingency plan which was a part of the recent CBDRR activity in the village (Fig. 7). Firstly, local officials coordinated with the school coordinators and municipal officials and helped to arrange and organise the rooms for the evacuees. They reassigned the rooms so that families from the same hamlets were reunited, making it easier for the village police and health workers (assigned to particular hamlets) to monitor the evacuees, for curfews and cleanliness, respectively. Mothers helped the government authorities in food preparations, which then became easier, faster and more efficient. Pregnant and nursing women, and older and sick people were allocated rooms. The village chief and councillors gave regular updates to the evacuees on the situation in the evacuated village, particularly on the damages incurred.

The successful management by local actors of the evacuation center was attributed to the recent CBDRR program in the village. Aware of the new village contingency plan, school coordinators and municipal officials decided to entrust the management of the evacuation center to the evacuees. The contingency plan thus underpinned the local officials' and evacuees' actions during the evacuation. According to an elected official from the village, "When we made the (contingency) plan, we thought it was for compliance purposes only … But now we know we can use it to make our situation better in the evacuation center and to justify our actions."

Moreover, the 3-dimensional map assisted the initial assessment of volcanic impacts immediately after the eruption. It aided local officials in locating the areas most affected by ash fall, and in assessing the damage to shelters and farms. Damage and needs assessment by the local people and authorities and delivery of reports to concerned higher government authorities then became faster and more efficient. Altogether, the CBDRR program contributed to the success of the management of the evacuation center and post-disaster damage assessment through the leadership of the local actors and with the support of the outside actors.

5 Participation, Inclusion, and Empowerment of Local Actors in Volcanic DRR

This chapter has emphasized that participation of local actors offers numerous potential means to improve many aspects of DRR. Dialogue during participatory activities plays a vital role in the integration of knowledge across the different actors of DRR. Eventually, this integration leads to combination of top-down and bottom-up actions and is likely to be more efficient, context-appropriate, and sustainable (Wisner et al. 2012). If properly facilitated, it may result in local empowerment that allows local actors to

Fig. 7 Local leaders from the village of Cogon, Irosin, Philippines discussing with a municipal health officer the implementation of the village's evacuation plan (*left*). A village health worker conducting the registration of evacuees for easy health monitoring and distribution of relief goods (*right*). *Photograph by* J. Cadag, 22 Feb 2011

assess disaster risk, enhance their capacities and reduce underlying vulnerabilities (Pelling 2007; Maskrey 2011; Cadag and Gaillard 2012).

The case study of Mount Rainier reaffirms four important aspects of participatory approaches that are relevant in volcanic DRR. Firstly, collaboration among local and outside actors of DRR is possible when participation is sought. Local actors have been successfully integrated in DRR through long-term engagement and dialogue using a variety of participatory approaches. While enthusiasm and resources for various projects within the CBDRR have waxed and waned over the years, it is the long-term commitment by local and outside actors that has sustained the CBDRR effort. Secondly, participatory approaches should not be evaluated solely on the basis of immediate results but also on long-term positive outcomes. It is therefore important to reemphasize that process is equally or, in the long term, even more important than the original desired short-term outcomes. Thirdly, participatory approaches can empower local actors and encourage them to become key actors of DRR. The Rainier case study involved local actors who are self-motivated and resourceful, who are aware of the hazard, and who can develop plans and take actions. This example illustrates that participatory approaches, accomplished with sufficient intention, vigor, resources, and commitment by local and outside actors can produce positive outcomes.

Fourthly, sometimes CBDRR requires outside actors to make shifts in power relation in unconventional ways. As an example, at Mount Rainier, local officials and media requested successfully that scientists modify their usage of traditional scientific terminology to reduce miscommunication in education and during crises. At their request, the term 'debris flow' is applied only to small seasonal events that can not directly impact communities, while the term 'lahar', similar in structure but vastly larger in scale, refers to events that could create serious impacts, principally during eruptions and debris avalanches. Similarly, the term 'active' is applied consistently to Mount Rainier to reflect the internal volcanic processes present, even during quiescence. More recently, these specific and process-oriented applications of terminology are applied broadly by officials in other volcano-hazard work groups within the Cascade Range. In this manner, the expeditious nature of top-down decision-making is traded for authenticity and intentional efficiency within the larger mitigation effort. In the case of Bulusan Volcano, local leaders and residents were involved in risk assessment and contingency planning prior to the eruption, and then took on the role as managers during the crisis. The successful management of the evacuation center by the local actors (in cooperation with outside stakeholders) so early in the crisis is commendable. This positive outcome highlights the importance of participation by local actors including the marginalized sectors (i.e. homeless, people with disabilities, the economically disadvantaged, women, children, people of a variety of sexual orientations, etc.) in all aspects and stages of volcanic DRR. Moreover, volcanic crisis and evacuation management plans were localized yet consistent with the plans of outside actors, putting emphasis on the role of local actors as first responders in times of crisis, whilst reinforcing the importance of outside actors in fulfilling the lack of resources at the local level, particularly in dealing with large scale crises (Delica-Willison and Willison 2004; Cadag and Gaillard 2012).

Some of the important insights emerging from these two case studies relate specifically to trust, dialogue, participatory methods, and empowerment. This study is consistent with the findings of previous work on trust and risk communication (e.g., Haynes et al. 2008). Generally, trust means confidence in the reliability of someone or something. In risk communication, trust is determined by several factors such as general trustworthiness (e.g., competence, care, fairness, and openness) and scepticism (e.g., credibility, reliability, and integrity) (Poortinga and Pidgeon 2003, p. 607). The case studies reinforced that participation builds trust among local and outside actors of DRR, which eventually results in more fruitful collaboration and better DRR. Programs that involve community participation empower local actors and eventually encourage them to

trust government authorities and their information (Paton et al. 2008), and vice versa—outside actors gain respect for local knowledge.

Achieving trust, however, is difficult. Trust is only possible when actors of DRR are fully engaged in a process of dialogue, i.e. the continuous exchange of knowledge, ideas, and opinions. Dialogue is a means for DRR actors (particularly marginalized sectors) to be heard on equal footing with other actors (Heijmans 2009) so as to: "respect the diversity of opinions" (Abarquez and Murshed 2004, p. 81). Dialogue, therefore, promotes integration of knowledge and action in DRR (Wisner et al. 2012; Gaillard and Mercer 2013).

To sustain trust and dialogue among actors, participatory methods and tools must also be sustainable, i.e. maintained and adapted at the local level by local actors who recognise (without being dependent upon) the contributions of outside actors. This is best achieved when local actors have active roles in the conceptualization, conduct, and maintenance of participatory approaches (Cadag and Gaillard 2012). This is the case of CBDRR in Bulusan Volcano where local actors have indicated greater interest in improving their 3D map and local plans to further strengthen their disaster preparedness.

In spite of their successes, in these case studies, challenges extend to both local and outside actors. As noted in the Mount Rainier example, during long-lasting efforts, it is inevitable that politics play a strong role; volunteers reach fatigue; agency personnel change; and competing priorities threaten the main objectives of DRR efforts. Outside actors are often prohibited by the institutionalized top-down and command-and-control paradigm of DRR, which logically contradict the idea of local participation and empowerment. Meaningful efforts to promote empowerment and participation require that outsiders recognise the need for change within their institutions, which is emphasised by Chambers (1995, p. 197):

> Participation "by them" ['local actors particularly the marginalised sectors] will not be sustainable or strong unless we ['outside actors'] too are participatory. "Ownership" by them means non-ownership by us. Empowerment for them means disempowerment for us. In consequence, management cultures, styles of personal interaction and procedures all have to change.

6 Considerations for Policy and Practice of DRR in Volcanic Environments

This chapter highlights a number of lessons for CBDRR policy and practice in volcanic environments. It reaffirms that:

1. Participatory approaches in CBDRR initiate the personal and community progression from personalizing and then, confirming the risk with others, developing intentions for action, that are required to take action during a crisis, as noted variously by several authors (i.e. Sorensen 1982; Sorensen and Mileti 1987; and Paton 2003).
2. CBDRR can be well suited for volcanically hazardous areas as some appropriate emergency responses such as residents identifying locally understood and recognizable hazardous phenomena, developing locally-based neighborhood notification methods, self evacuation, and sheltering often requires the individual or community to be self reliant.
3. Dialogue developed through volcanic CBDRR can promote trust among all actors, which in turn sustains CBDRR efforts.
4. Co-development of hazard and response messages early on, and consistent use of them by local and outside actors can facilitate educational processes, and lay a foundation for sustainable CBDRR.
5. Participatory approaches can invite inquiry, such as the search for information that reinforces people's recognition of the hazard, and discussion about DRR. As with any educational activity, participation is the best teacher because it provides local actors with the knowledge to educate and empower others.

6. CBDRR can operate over short and long durations. The key components are that the process is collaborative and emphasises local actors in the processes of organization and planning for future necessary actions. While the resources of outside actors can strengthen CBDRR, planning should be accomplished, communicated, and practiced principally by local actors.
7. The value may be limited by vested interests within the community, fatigue of all actors, changing personnel, as well as other cultural and political or hazard issues that compete for focus. The actors may not understand each other's culture and resources, leading to unrealistic goals and expectations. Local actors can become insular and exclude new ideas and/or the needs of marginalized people, thus becoming, for all practical purposes, another group of 'outside actors.'
8. While governments and organizations may profess support for CBDRR, there is always a threat that, on a more personal level, outside actors will withdraw from CBDRR precepts for the sake of immediate efficiency, such that they damage outside/local actor relationships and the CBDRR that they seek to engender.
9. In addition to participatory approaches to CBDDR, in volcanic environments it is important to consider the value of legislative instruments and the legal responsibilities of government to protect the life of their citizens, thus directly affecting governmental decision-making. However, in some countries, legislation to manage volcanic DRR focuses mainly on crisis management often detached from larger risk reduction efforts such as land-use policy, protection of infrastructure and overcoming unequal power relations within society. Furthermore, crisis management planning is often restricted to government authorities with little or no community consultation and participation.
10. To achieve effective DRR in volcanic environments, an intense process of facilitation and negotiation is required of scientists, policymakers and the public. This is especially necessary during long term crises characterized by shifting political, cultural and scientific landscapes (Donovan and Oppenheimer 2014). Scientific knowledge can be enhanced by the participation of local actors as citizen scientists (see Irwin 1995) and observers of volcanic activity (e.g., Stone et al. 2014).
11. In order to be effective, legislative instruments for DRR should be created and applied well in advance of a crisis and should involve all stakeholders, including local people and others exposed to the prevailing hazards.

7 Conclusion

Although limited to two case studies, this study provides examples and discussions which support the supposition that volcanic DRR is more effective when local actors participate, regardless of volcanic environments or contexts. CBDRR exists in varying forms across volcanic regions around the world, as exemplified by the long CBDRR ongoing at Mount Rainier and the short-term initiative at Bulusan volcano. Given that each volcano and surrounding communities have their own specific context, it is difficult and against best practice to determine a rigid and standardized procedure for conducting CBDRR. Rather than seeing this as an obstacle, it should be embraced as an opportunity to develop customized means to fulfil community needs.

Whilst it is not possible to standardise CBDRR, a number of guiding principles for fostering the participation of local actors in DRR have been identified. Firstly, participation is a process, not an outcome, and it should empower local people and build dialogues. This reduces dependence upon outside actors and resources, and encourages reliance on local capacities. Participation must be flexible and is only as good as the knowledge, intentions and resources available to local actors. At their best,

participatory approaches encourage collaborative contributions by both local and outside actors, the latter providing knowledge, resources and skills to complement the strengths of the former. Such approaches promote dialogue and co-production of knowledge between the community and outside actors. CBDRR should work in tandem with top-down, legislative processes, with local and outsider actors holding each other accountable. The personal and professional relationships developed with local actors can spur outside actors to continue to support efforts, whilst the attention from outside actors can motivate local actors to maintain CBDRR. The process should, therefore, be mutually beneficial. Finally, whilst it can be challenging to engage and maintain the participation of both local and outside actors, CBDRR has been demonstrated as an essential component in sustaining ownership and communication between key actors in volcanic settings. Indeed, the true value of CBDRR is not only measured in products or documents, but also in creating a conducive environment for collaboration where the hearts, minds and trust of the people are devoted. It is an environment where local actors are empowered to implement DRR plans and actions and where policies that institutionalize peoples' participation and multi-actor collaboration are in place.

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